DESIGN MEMORANDUM

ON

IMPROVEMENT DREDGING

PROVIDENCE RIVER AND HARBOR

RHODE ISLAND

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

12 MAY 1967

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO

NEDED-T

12 May 1967

SUBJECT: Design Memorandum on Improvement Dredging Providence River and Harbor, Rhode Island

TO: Chief of Engineers
ATTN: ENGCW-E

Submitted herewith in accordance with ER 1110-2-1150 are ten (10) copies of Design Memorandum for review and approval.

FOR THE DIVISION ENGINEER:

JOHN Wm. LESLIE
Chief, Engineering Division

1 Incl
as (10 cys)

DEPARTMENT OF THE ARMY
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DESIGN MEMORANDUM
ON
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PROVIDENCE RIVER AND HARBOR
RHODE ISLAND

PERTINENT DATA

1. Purpose: To review the authorized project modification, arrive at a final plan of improvement, and to prepare an up-to-date estimate of project cost based on more recent detailed field surveys.

2. Location: Providence River is a tidal estuary extending northerly from the upper limits of Narragansett Bay about 8 miles inland to the City of Providence. The upper 2-1/2 miles comprise the Main Harbor which is that portion of the river south of Fox Point and India Point and extending generally south of Field Point. The 40-foot authorized Main Channel extends from deep water in Narragansett Bay just south of Prudence Island Light northerly to Fox Point at Providence.

3. Project Authorization: River and Harbor Act of 27 October 1965.

4. Project Document: Senate Document No. 93, 88th Congress, 2nd Session.

5. Recommended Project Plan:

A channel 40 feet deep, generally 600 feet wide from deep water in Narragansett Bay just south of Prudence Island Light to the turn below Field Point at Providence, and thence up to 1,700 feet wide to the existing project limit at Fox Point, with easing of bends to a minimum radius of 5,000 feet and excluding the marginal strip 75 feet wide channelward of the established harbor lines; and

A channel 30 feet deep and 150 feet wide, extending northeastward from the upper end of the existing project to the vicinity of India Point at the mouth of the Seekonk River; all generally in accordance with the plan of the Division Engineer as shown on the map accompanying his report and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable.

6. Estimated First Cost of Construction:

a. 40-Foot Main Channel

TOTAL CONSTRUCTION COST (Corps of Engrs. Funds Only	$14,130,000
Aids to Navigation (Coast Guard)	53,000
TOTAL PROJECT COSTS (Federal)	$14,183,000
Non-Federal (Berth Improvements) (Self-Liquidating)	300,000
TOTAL (Federal and Required Non-Federal Costs)	$14,483,000

b. 30-Foot India Point Channel

TOTAL CONSTRUCTION COST (Corps of Engrs. Funds Only)	$225,000
Aids to Navigation (Coast Guard)	5,000
TOTAL PROJECTS COSTS (Federal)	$230,000
Non-Federal (Berth Improvements) (Self-Liquidating)	55,000
TOTAL (Federal and Required Non-Federal Costs)	$285,000

b. 30-Foot India Point Channel

Federal

Corps of Engineers	$13,200
U. S. Coast Guard	500
TOTAL FEDERAL	$13,700
NON-FEDERAL	$ 0

9. Benefit - Cost Ratios:

a. 40-Foot Main Channel

$765,500/$621,900 = 1.2 to 1

b. 30-Foot India Point Channel

$22,800/$13,700 = 1.7 to 1

c. Combined Improvement

$788,300/$635,600 = 1.2 to 1

10. Requirements of Local Cooperation:

a. Hold and save the United States free from damages due to the construction works and maintenance of the project; and

b. Provide and maintain without costs to the United States depths in berthing areas commensurate with those in related project areas.

7. Benefits:

a. 40-Foot Main Channel

Savings in transportation costs by use of larger tankers and elimination of tidal delays to present tankers	$765,500
TOTAL BENEFITS 40-Ft. Main Channel	$765,500

b. 30-Foot India Point Channel

Shifting vessels from India Street to Field Point	$ 3,600
Dockage and wharfage charges to Field Point	2,800
Trucking charges from India Street to Field Point	9,200
Demurrage charges	7,200
TOTAL BENEFITS 30-Ft. India Pt. Channel	$ 22,800

8. Annual Charges:

a. 40-Foot Main Channel

Federal

Corps of Engineers	$619,500
U. S. Coast Guard	2,400
TOTAL FEDERAL	$621,900
NON-FEDERAL	$ 0

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REQUIREMENTS OF LOCAL COOPERATION

3. The provisions of local cooperation, as required by documents authorizing the existing project and the improvements that preceded it, have been fully complied with. The improvement considered in this design memorandum is the work authorized by the River and Harbor Act of 1965, as described in paragraph 2. The project modification was authorized subject to the requirements that, prior to construction, local interests agreed to:

(a) Hold and save the United States free from damages due to the construction works and maintenance of the project; and

(b) Provide and maintain without cost to the United States depths in berthing areas commensurate with those in related project areas.

INVESTIGATIONS

4. Physical investigations carried out in support of the survey report contained in Senate Document No. 93, 88th Congress, 2nd Session, were made in 1959, 1960, 1961, and 1962. The investigations consisted of hydrographic and probing surveys. Topography was taken from previous surveys and from U. S. C. & G. S. Charts 236 and 278.

5. Additional probings, supplemented by borings and sounding surveys, were accomplished in 1966. Detailed probings were made on 600, 300, 100, and 50, and 25 foot spacings in 1966. A total of 24 core and drive borings were made in the probed areas. The supplemental soundings were obtained in 1963 between North Point and Sabin Point; and in 1965 in the vicinity of Popasquash Neck; and between Prudence Island and Hog Island.

STATUS OF LOCAL COOPERATION

6. The requirements of local cooperation, as specified by the authorizing document are stated in paragraph 3 above. Formal assurances were forwarded 28 April 1967 to the Director, Department of Natural Resources, State of Rhode Island, and the City of Providence and City of East Providence for signature. It is expected that the State and Cities will each execute the necessary assurances that the requirements of local cooperation will

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PROVIDENCE RIVER AND HARBOR
RHODE ISLAND

DESIGN MEMORANDUM

PROJECT AUTHORIZATION

1. The existing project for Providence River and Harbor was authorized by the River and Harbor Act of 26 August 1937 (H. Doc. 173, 75th Cong., 1st Sess.). The existing project provides for an approach channel 35 feet deep at mean low water and generally 600 feet wide through the river from deep water of Narragansett Bay, opposite North Point on Popasquash Neck, to the turn below Field Point, 8.1 miles, and thence about 2.6 miles with the same depth and of width ranging up to 1,700 feet to Fox Point, excluding a marginal strip 75 feet wide channelward of the established Harbor lines. The existing project was completed in 1949, at a cost of $2,322,029.

2. The uncompleted modification for the improvement of Providence River and Harbor was authorized by the River and Harbor Act of 27 October 1965 (S.D. 93, 88th Cong., 2nd Sess.). The project, as authorized, modifies the existing project to provide for:

> A channel 40 feet deep, generally 600 feet wide from deep water in Narragansett Bay just south of Prudence Island Light to the turn below Field Point at Providence, and thence up to 1,700 feet wide to the existing project limit at Fox Point, with easing of bends to a minimum radius of 5,000 feet and excluding the marginal strip 75 feet wide channelward of the established harbor lines; and
>
> A channel 30 feet deep and 150 feet wide, extending northeastward from the upper end of the existing project to the vicinity of India Point at the mouth of the Seekonk River; all generally in accordance with the plan of the Division Engineer as shown on the map accompanying his report and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable.

that the cost to local interests would be of a major magnitude and apparently far beyond financing that this Commission can visualize. However, the Commission is not quite ready to drop the idea entirely without exploring further with some of the local industries the possibility of a smaller-scale development of this nature.

10. The Commission has no desire nor intention to delay the advertising for bids on the Federal channel dredging. It does expect to spend apparently some months in exploring further whether there is any feasible project that might be developed in East Providence in connection with the channel dredging. If such a project is found, then the Commission intends to bring it up during the 3 to 4 year period of the Federal channel dredging.

LOCATION AND TRIBUTARY AREA

11. Providence River is a tidal estuary extending northerly from the upper limits of Narragansett Bay about 8 miles inland to the City of Providence. The upper 2-1/2 miles comprise the Main Harbor, which is that portion of the river south of Fox Point and India Point and extending generally south of Field Point. The Outer Harbor consists of a 35-foot approach channel, dredged from the Main Harbor southerly to a point just west of North Point. The approach channel has a minimum width of 600' and is about 8 miles long. The mean range of tide is 3.9 feet at Prudence Island opposite Sandy Point, 4.6 feet at Nayatt Point; and 4.6 feet at Providence. The spring range of tide is 4.9 feet at Prudence Island opposite Sandy Point, 5.7 feet at Nayatt Point, and 5.7 feet at Providence.

12. The tributary area of the Port of Providence covers approximately 2,000 square miles and consists of most of the State of Rhode Island, the northeastern section of the State of Connecticut, and extends into central and southeastern Massachusetts. This area is contiguous with those of the nearby ports of Boston, Fall River, and New Bedford. The exact size of the area differs with the commodity involved, and for the petroleum industry, it varies with the particular distributing oil company. For this reason the exact population is indeterminate, but it seems conservative to state that it is in excess of 1,250,000.

13. Metropolitan Providence is principally industrial with well-diversified manufacturing, textiles, lace goods,

be met. It is currently estimated that the cost to local interests for berth improvements will amount to $355,000.

7. Coordination with State and local interest have been and are still in progress with respect to the project. In connection with the above described assurances, at the request of the Cities of Providence and East Providence, letters were sent on 8 May 1967 to clarify the responsibilities of the Cities with respect to the indemnification requirement and the requirements for berth improvement.

8. On 25 April 1967, representatives of the Corps met with the East Providence Industrial Development Commission and with city and State officials concerned relative to the feasibility of relating a waterfront development in East Providence with the Federal channel deepening project. The following were those in attendance at the meeting:

Louis Guenther, Chairman, East Providence Industrial Development Commission
Everett G. Maillour, Vice Chairman, "
Roy Hendrikson, Secretary "
Dr. Holtz (absent), Member "
Henry Isé, Chief, R. I. Division of Harbors & Rivers, Dept of Natural Resource
Joseph Savick, Acting City Manager, East Providence
George Caldow, Chief, Division Planning, City of East Providence
Jacob Harpootian, State Representative

9. The Industrial Development Commission was formed about a year ago to find some way of attracting industry to East Providence. As a result of information concerning the imminent dredging of the Providence River channel, the Commission felt that there might be a possibility of re-claiming waterfront land or making new land over existing mud flats that could be developed as a waterfront industrial site. The Chairman of the Commission apparently is impressed with the possibility of starting a container-ship operation in the Port of Providence and feels that the large land areas required might be obtained in this fashion. There was considerable information given to the Commission in this discussion relative to the problems that should be realized - namely, poor foundation conditions, rather unsuitable character of materials to be dredged for use as landfill, and extensive dikes or bulkheads to hold the fill in place. It became apparent

PROJECT PLAN

16. The project plan includes the removal and disposal of ledge rock and ordinary materials to a depth of 40 feet in the existing 35-foot channel, and the extension of that channel in a southerly direction for a distance of about five miles to a point just south of Prudence Island Light. The plan includes easing the critical bends by increasing the minimum radius for two-lane traffic to at least 5,000 feet. This would require the removal of Sabin Point Light and the construction of a new light structure to the east of the proposed channel limit. The plan also includes deepening India Point channel to 30 feet for a width of 150 feet, to a point opposite the Tidewater Terminal and Stevedoring Company Wharf.

17. In order to provide a clear channel depth of 40 feet in the main channel, the project plan involves the drilling, blasting and removal of about 15,000 cubic yards of ledge rock to a required depth of 42 feet plus 2 feet of allowable overdepth, and the dredging of about 8,500,000 cubic yards of ordinary material to a depth of 40 feet plus 2 feet allowable overdepth. The required 42-foot depth in rock areas is in accordance with standard design criteria for removal of underlying rock to enable future project maintenance to a clear depth of 40 feet. The two-foot allowable overdepth provides for inaccuracies in dredging process at the specified depth and insures attainment of project depth. In addition, the project plan involves the removal and disposal of about 135,000 cubic yards of ordinary material to deepen the India Point channel to a depth of 30 feet, plus an allowable overdepth of 2 feet.

18. An evaluation of the materials to be excavated from the Providence River and Harbor was made based on the results of the boring and probing survey made in 1966. Consideration was given to the possiblity of using the hydraulic method for landfill. The predominant materials to be excavated are soft organic silt and clay, glacial till and rock, with minor amounts of silty sand. Shore and offshore placement of the above type of materials would involve expensive retention structures in view of soft mud formation of available areas along and adjacent to the shore. Further, the materials to be dredged are considered unsuitable for fill purposes and would result in an offensive nuisance. Although some silty sand is expected to be

jewelry, machinery, fabricated metals, and rubber goods being among the leading products. Most of the high-grade manufactured products shipped out of the area move by rail or truck, the greater preponderance being routed through New York. Providence is served by the main line of the New York, New Haven and Hartford Railroad, which links the port both with the tributary area and also all sections of the country having rail facilities. The port is also served by trucking companies connecting Providence, by major highways, with all sections of New England.

14. There are 27 water terminal facilities serving the port of Providence. Three-fourths of all facilities have railway connections. Four facilities are owned by the City of Providence and two by the State of Rhode Island.

15. At present there are ten wharves with major oil-handling capabilities, on the 35-foot main channel. These wharves are listed below:

East Providence
- Socony-Mobil Oil Company Wharf
- Atlantic Refining Company Wharf
- Mexican Petroleum Corporation and American Oil Company Wharf - (Kettle Pt.)
- Gulf Oil Corporation Pier
- Wilkesbarre Pier

Providence
- Mexican Petroleum Corporation and American Oil Company Pier - (Public St.)
- Harbor Junction Pier
- Narragansett Electric Company (below Fox Pt. barrier)
- Sun Oil Company Wharf
- Municipal Wharf

It is not necessary that all ten be improved to assure full use of a deeper channel. It is expected that the more important berths will be dredged immediately. Competition will result in improvement to the other berths over the life of the project as larger vessels come into use.

On the India Pt. channel, there is only one wharf currently engaged in commerce. This wharf, with a berth depth of 22 feet, is owned by the Tidewater Terminal and Stevedoring Co. This berth would have to be deepened to a depth commensurate with the proposed 30-foot channel.

40-foot Main Channel will be required. The current estimate of cost is based on quantities determined from previously mentioned surveys, and supplemented by more recent detailed probing and boring surveys made in 1966, and more recent sounding surveys made in 1963 and 1965 in parts of the Main Channel. Dredging quantities are in terms of in-place measurement with a 2-foot overdepth allowance. The materials to be encountered include both rock and ordinary material, and the required grade for rock was taken as two feet below project depth. All material was assumed to be removed by bucket dredge, placed in a scow and towed to a dumping ground in the ocean south of Narragansett Bay. Side slopes were assumed to be 1 vertical on 1 horizontal in rock and 1 vertical on 3 horizontal in ordinary material. Since the work will be accomplished under a continuing contract over a period of an estimated 4 years, an allowance for channel shoaling has been included in the quantity estimates. Estimates of first cost are based on prices prevailing in May 1967, and are tabulated below for the proposed 40-foot improvement. The work contemplated will require the removal of approximately 8,500,000 cubic yards of ordinary material, and 15,000 cubic yards of rock from the Main Channel, and 140,000 cubic yards of ordinary material from the 30-foot India Point channel.

excavated, it is considered to be impractical and uneconomical to delineate these areas from the point of view of the elaborate field explorations required to define the areas, and secondly, the involvement of two types of overlapping dredging operations.

19. In addition, in view of the developed areas along the project route, the recreational aspects of the surrounding areas, the conservation principles of other Federal and State agencies for the preservation to marshlands for fish and wildlife resources, and elimination or minimization of pollution, it is considered highly improbable that sufficient areas for disposal of the volume of materials to be excavated could be made available. Accordingly, it is considered that the most practical and economical manner of accomplishing the work will be by means of a bucket dredge with disposal in a dumping ground at sea, south of Narragansett Bay. Disposal at sea, as proposed, is being coordinated with the U. S. Fish and Wildlife Service and the Federal Water Pollution Control Administration in accordance with regulations.

DEPARTURES FROM PROJECT DOCUMENT PLAN

20. The present project plan is the same as that recommended in the authorizing document and authorized by Congress. With the exception of refinement of the project cost estimates based on more detailed field investigation completed during the planning phase, no changes in the document project plan have been made. Overdepth allowance presently contemplated are the same as those used in the authorizing document.

COST ESTIMATES

21. The estimate of project cost determined in the authorizing document was based on probing and boring surveys made from 1938 through 1943, during the deepening of the present channel to 35 feet. Additional random drive probings were taken in 1962. Soundings were taken by fathometer and are from surveys of 1959, 1960, 1961, and 1962. It was estimated that 8,800,000 cubic yards of ordinary material, and 25,000 cubic yards of rock would be required to be removed from within project limits from the 40-foot Main Channel, and 135,000 cubic yards of ordinary material would be required to be removed from the 30-foot India Point Channel. The removal of Sabin Point Light from within the project limits of the

22. CURRENT ESTIMATE OF COSTS (May 1967)

40-Foot Main Channel

Dredging	
Ordinary Material 8,500,000 cy @ $1.30/cy	$11,050,000
Rock - 15,000 cy @ $30/cy	450,000
Removal of Sabin Pt. Light	20,000
	$11,520,000
Contingencies 15%	730,000
TOTAL CONTRACT COSTS (40-Ft. Main Channel)	$13,250,000
Engineering and Design-	350,000
Supervision and Administration	530,000
TOTAL CONSTRUCTION COST (Corps of Engrs Funds Only)	$14,130,000
Aids to Navigation (Coast Guard)	53,000
TOTAL PROJECT COSTS (Federal)	$14,183,000*
Non-Federal (Berth Improvements) (Self-Liquidating)	300,000
TOTAL (Federal and Required Non-Federal Costs)	$14,483,000

* Exclusive of $55,000 Preauthorization Studies

22. CURRENT ESTIMATE OF COSTS (May 1967) (Cont.)

30-Foot India Point Channel

Dredging	
Ordinary Material	
140,000 cy @ $1.30/cy	$182,000
Contingencies 15%	27,000
TOTAL CONTRACT COSTS (30-Ft. Indian Pt. Channel)	$209,000
Engineering and Design	6,000
Supervision and Administration	10,000
TOTAL CONSTRUCTION COST (Corps of Engrs Funds Only)	$225,000
Aids to Navigation (Coast Guard)	5,000
TOTAL PROJECT COSTS (Federal)	$230,000*
Non-Federal (Berth Improvements) (Self-liquidating)	55,000
TOTAL (Federal and Required Non-Federal Costs)	$285,000

* Excludes $2,000 Pre-authorization Studies

23. COMPARISON OF COSTS (Cont.)

30-Foot India Point Channel

	Document Estimate (Dec 1962)	Latest Approved Estimate (Jan 1967)	Current Estimate (May 1967)
Channel Dredging	135,000 @ $1.20 $160,000	135,000 @ $1.20 $160,000	140,000 @ $1.30 $182,000
Contingencies 15%	24,000	24,000	27,000
TOTAL CONTRACT	$184,000	$184,000	$209,000
Engineering & Design	6,000	6,000	6,000
Supervision & Administration	10,000	10,000	10,000
TOTAL COSTS (Corps of Engrs.)	$202,000*	$202,000*	$225,000*
Aids to Navigation (Coast Guard)	5,000	5,000	5,000
TOTAL COST FEDERAL	$207,000	$207,000	$230,000
Non-Federal Berth Improvements	50,000	50,000	55,000
TOTAL (Federal and Required Non-Federal Costs)	$257,000	$257,000	$285,000

* Excludes $2,000 Pre-authorization Studies

23. COMPARISON OF COSTS

40-Foot Main Channel

	Documant Estimate (Dec 1962)	Latest Approved Estimate (Jan 1967)	Current Estimate (May 1967)
Channels Dredging	8,800,000 @ $1.20 $10,560,000	8,800,000 @ $1.20 $10,560,000	8,500,000 @ $1.30 $11,050,000
Rock Removal	25,000 @ $30.00 $750,000	25,000 @ $30.00 $750,000	15,000 @ $30.00 $450,000
Removal of Sabin Pt. Light	20,000	20,000	20,000
Contingencies 15%	$ 1,700,000	$ 1,690,000	$ 1,730,000
TOTAL CONTRACT	$13,030,000	$13,020,000	$13,250,000
Engineering & Design	150,000	350,000	350,000
Supervision & Administration	520,000	530,000	530,000
TOTAL COSTS	$13,700,000*	$13,900,000*	$14,130,000*
Aids to Navigation (Coast Guard)	53,000	53,000	53,000
TOTAL COST FEDERAL	$13,753,000	$13,953,000	$14,183,000
Non-Federal Berth Improvements (Self-Liquidating)	275,000	275,000	300,000
TOTAL (Federal and Required Non-Federal Costs)	$14,028,000	$14,228,000	$14,483,000

* Exludes $55,000 Pre-authorization Studies

estimated quantity is 3 months. Present project schedule, contingent on funding and fulfillment of the requirements of local cooperation is as follows:

Issue advance notice	15 May 1967
Issue Plans & Specifications	26 May 1967
Open bids	23 June 1967
Award contract	28 June 1967
Start construction	15 July 1967
Complete construction	30 June 1971

27. Time required for completion of the entire project is 48 months. Fund requirements for the above schedule is as follows:

	Main Channel	India Pt. Channel
Allotted to 30 June 1966	$ 165,000	
Fiscal Year 1967	400,000	
Fiscal Year 1968	3,500,000	
Fiscal Year 1969	3,500,000	
Fiscal Year 1970	3,500,000	
Fiscal Year 1971	3,065,000	$225,000
	$14,130,000	$225,000

OPERATION AND MAINTENANCE

28. Maintenance of the project is the responsibility of the United States and will consist of periodic dredging to restore project depths within the limits of the authorized Federal project modification. The additional annual maintenance cost is estimated at $20,000 based on an average annual deposition over the dredged area 14,000 cubic yards.

BENEFITS

29. The benefits expected to accrue from construction of the improvement are the same as those in the authorizing document.

30. Benefits for the 40-foot Main Channel have been based on the savings in transportation costs of petroleum products by the use of larger oil tankers and the reduction in tidal delay to tankers already in use.

31. Definite intangible benefits will result from easing the bends in the existing channel. No monetary value has been placed on the effect of the proposed smoother bends, however the larger radii should result in savings both in operating costs and also in the reduction in hazard to navigation. In the past there have been many instances when incoming tankers have almost run aground due to the sharpness of the channel bends. No serious mishaps have occurred as yet, but there is a strong possibility that a serious catastrophe could occur unless the radii of the critical bends are lengthened.

32. Benefits to the India Point Channel have been based on the elimination of additional vessel charges and the reduction in loading costs caused by the present practice of loading at two terminals.

33. The cargo required to complete the loading at Field Point must be shifted from the India Street terminal by truck to Field Point. In addition, the loading facilities at Field Point are much less efficient than those at the India Street terminal. Extra costs are incurred in shifting vessels to Field Point, in dockage and wharfage fees at Municipal Wharf, in trucking cargo between terminals, and in the reduced loading efficiency at Municipal Wharf.

34. The benefits anticipated to accrue from the improvement are summarized as follows:

SUMMARY OF BENEFITS
(50-Year Project Life)

40-Foot Main Channel

Savings in transportation costs by use of larger tankers and elimination of tidal delays to present tankers	$765,500
TOTAL BENEFITS 40-Foot Main Channel	$765,500

Federal Annual Charges

Investment	$15,066,000
Project Life	50 years
Interest and Amortization (3-1/8%)	599,500
Additional channel maintenance	20,000
Annual Maintenance Navigation Aids	2,400
Federal Annual Charges 40-foot Main Channel	$ 621,900

30-foot India Point Channel
Federal Investment

First Cost-Corps of Engineers	$ 225,000
First Cost-Coast Guard	5,000
Total Federal Investment (30-foot India Point Channel)	$ 230,000

Federal Annual Charges

Investment	$ 230,000
Project Life	50 years
Interest and Amortization (3-1/8%)	9,200
Annual Maintenance Channel	4,000
Annual Maintenance Navigation Aids	500
Federal Annual Charges (30-foot India Point Channel)	$ 13,700

36. 40-foot Main Channel - A comparison of annual benefits of $765,500 to the estimated annual charges of $621,900 for the 40-foot Main Channel yields a current benefit-cost ratio of 1.2 to 1.

37. 30-foot India Point Channel - A comparison of annual benefits of $22,800 to the estimated annual charges of $13,700 for the 30-foot India Point Channel yields a current benefit-cost ratio of 1.7 to 1.

38. Combined Improvement - A comparison of annual benefits of $788,300 to the estimated annual charges of $635,600 for the combined 40-foot Main Channel and the 30-foot India Point Channel yields a current benefit-cost ratio of 1.2 to 1.

RECOMMENDATIONS

39. The plan of improvement proposed in this design memorandum provides for:

A channel 40 feet deep, generally 600 feet wide from deep water in Narragansett Bay just south of Prudence Island Light to the turn below Field Point at Providence, and thence up to 1,700 feet wide to the existing project limit at Fox Point, with easing of bends to a minimum radius of 5,000 feet and excluding the marginal strip 75 feet wide channelward of the established harbor lines; and

A channel 30 feet deep and 150 feet wide, extending northeastward from the upper end of the existing project to the vicinity of India Point at the mouth of the Seekonk River; all generally in accordance with the plan of the Division Engineer as shown on the map accompanying his report and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable.

The plan is the same as that recommended in the authorizing document and authorized by Congress. This project plan will serve adequately the present and prospective needs of the harbor and economically is justified, provided the 30-foot India Point Channel would be commercially used for deep draft vessels. However, there are strong indications of plans for urban redevelopment in this area in which case a channel of lesser depth would be adequate and would eliminate the need for the authorized 30-foot depth. It is recommended that the 40-foot Main Channel portion of the authorized project be constructed as described. It is further recommended that construction of the 30-foot India Point Channel portion of the authorized project be deferred until a later date when a more definite plan for its need is determined.

Incl - Map (In 2 sheets)

CORPS OF ENGINEERS

U. S. ARMY

MATCH LINE-SHEET 2

E540000 E550000 E560000 E570000 E580000

N220000 N210000 N200000 N190000 N180000

WARWICK NECK

PATIENCE ISLAND

PRUDENCE ISLAND

POPASQUASH NECK

BRISTOL NECK

BRISTOL

AQUIDNECK ISLAND

BRISTOL HARBOR

MOUNT HOPE BAY

OHIO LEDGE

SOUTH LIMIT OF EXISTING 35-FT. PROJECT

40-FT. MAIN CHANNEL

600'

NORTH POINT

SQUASH

PUMP HOUSE (1961)

CASTLE I. FLR.

POP

PRUDENCE

POTTER COVE

NAG (1943)

HOG I. SUB I

HOG I. ISLAND

LEAST HOG

HOG I. SHOAL

N.E.C. (1961)

DYER

MOUNT HOPE BRIDGE HORZ CL 135 FT. FOR MIDDLE WIDTH OF 400 FT.

NOTES:

Topography taken from U.S.C.&G.S. charts 236 and 278, and U.S.E.D. survey.

Coordinates are on the State of Rhode Island Grid System.

See sheet 2 for "LOCATION & VICINTY MAPS".

Limits of dredging shown as block areas inside of 40' Main Channel, by hatching inside of 30' India Pt. Channel.

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY	TR. BY	CK. BY
J.W.C	J.W.C	

SUBMITTED: PROJECT ENGINEER

REVIEWED: CHIEF, HAM & B.E. SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

APPROVED: CHIEF, ENGINEERING DIVISION DATE

PROVIDENCE RIVER & HARBOR
RHODE ISLAND
IMPROVEMENT DREDGING
40 FOOT CHANNEL

SCALE IN FEET
2000 0 2000 4000 6000

TO ACCOMPANY
DESIGN MEMORANDUM
DATED MAY 12, 1967

SCALE 1 20000

DRAWING NUMBER
Pe. 451

SHEET 1 OF 2